PROJECT facts

U.S. DEPARTMENT OF ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Transportation Fuels and Chemicals

11/2001

DEVELOPMENT OF OXYGEN TRANSPORT MEMBRANE (OTM) FOR PRODUCTION AND TESTING OF SYNTHESIS GAS-DERIVED ULTRA-CLEAN FUELS

LEAD INDUSTRY PARTNER

Praxair
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PARTICIPANTS

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Nuvera Fuel Cells
15 Acorn Park
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Torix, Inc.
7165 Hart Street
Mentor, OH 44060

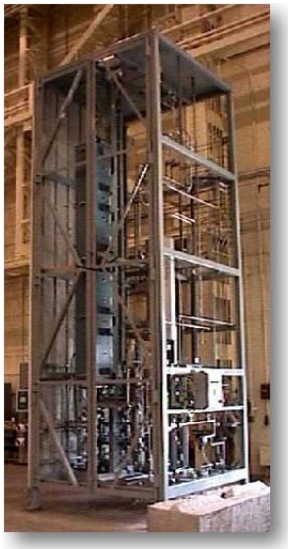
COST SHARING

DOE	$15 million
Non-DOE	$24.6 million

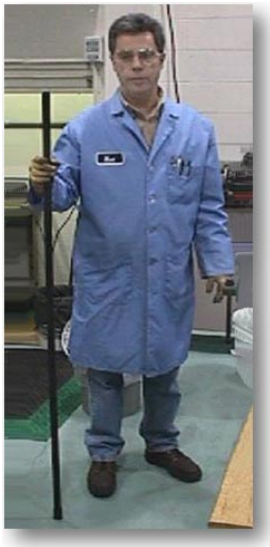
Description

Natural gas is an attractive feedstock for the production of ultra-clean fuels (UCF) because it is abundant and inexpensive, and can be converted into a number of sulfur free fuels including diesel, gasoline, and methanol and other oxygenates that can be used within the existing fuel distribution infrastructure. These fuels, when used neat, or when blended with petroleum based fuels, have the potential to dramatically reduce vehicle emissions from a number of propulsion systems including advanced IC (internal combustion) engines, fuel cells, and IC- fuel cell hybrids.

The processes for producing UCFs utilize a common first process step whereby natural gas is converted to synthesis gas, followed by a fuel-specific second process step to convert the synthesis gas into the desired fuel. Conversion of natural gas to synthesis gas is typically about 60% of the total fuel capital cost. Consequently, the economics of UCFs derived from natural gas, and hence their viability as transportation fuels, can be affected significantly by reducing the cost of converting natural gas to synthesis gas.



Single Large Format Tube Tester



Large Format OTM Tubes

Multi-tube Pilot Plant Reactor, P-1

Development of Oxygen Transport Membrane (OTM) for Production and Testing of Synthesis Gas-Derived Ultra-Clean Fuels

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The goals of the 3 year project are to (1) develop advanced synthesis gas technology, based on Oxygen Transport Membranes (OTMs), that will provide a step change reduction in the cost of converting natural gas to a spectrum of liquid transportation fuels and thereby improve the prospects for meeting vehicle emissions targets with cost competitive UCFs; (2) evaluate the performance of, and emissions from selected synthesis gas-derived UCFs in advanced vehicle propulsion systems, including advanced diesel engines with post treatment and fuel cells; and 3) develop an optimized UCF/diesel engine/exhaust aftertreatment system.

The project team includes stakeholders in every aspect of the value chain from natural gas production through fuel combustion including (1) resource holders, (2) resource producers, (3) conversion technology providers, (4) fuel producers, (5) advanced propulsion system developers and (6) engine manufacturers. The project team is led by Praxair, the largest producer of industrial gases in North and South America and a leader in developing OTM technology. Other team members are: BP Amoco, the largest natural gas holder and gasoline marketer in North America and inventor of the OTM synthesis gas process; Sasol, the world leader in Fischer-Tropsch synthesis of liquid fuels; Statoil, a major energy company with large natural gas reserves and OTM technology capability; International Truck and Engine Corp., a world leader in engine development and manufacturing; and Nuvera, a leader in development of fuel cells and on-board fuel processing technology.

The development team will employ a systems approach, in both developing the OTM synthesis gas technology and ultra-clean fuel blends and evaluating the impact of ultra-clean fuel properties on engine or fuel cell performance and exhaust treatment technologies. The team proposes to focus on the most cost sensitive step in the conversion of gas to ultra-clean fuels: the production of synthesis gas from natural gas. Praxair will be the prime contractor with significant work subcontracted to BP Amoco, International, and Nuvera. Statoil and Sasol will provide technical expertise and contribute technical development work. This superbly qualified team combines technical expertise, project management experience, and strong financial capabilities. In partnership with the DOE, this team is uniquely positioned to develop the technology considered crucial to the growth of economical ultra-clean fuel supplies.